

Frequently asked questions about LTAS.NET

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Cannot associate files with different databases.

Log file 'C:\Program Files\NIOSH\LTAS.NET\Data\MyCustomFileName_log.LDF' does not match the primary file. It may be from a different database or the log may have been rebuilt previously.

Deleting database file 'C:\Program Files\NIOSH\LTAS.NET\Data\MyCustomFilename.MDF'.

What is wrong and how do I fix it?

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General

Q-G1: What is the NIOSH Life Table Analysis System?

A-G1: The NIOSH Life Table Analysis System (LTAS.NET) is a software tool used to analyze groups ("cohorts") of people (usually workers) who are followed over time to determine if disease incidence or mortality is higher than expected among the group, either compared to a referent population or internally to compare higher- with lower-exposed people. In life table analyses, person-time and observed events are grouped into strata; standardized event rates are calculated among the strata to produce a standardized event ratio (compared to either a general population or to a group within the cohort). The standardization variables generally include age, sex, race, and calendar year. NIOSH has developed and distributed Life Table Analysis programs since the 1970s. The new system, LTAS.NET, was released in August 2007.

Q-G2: Why did NIOSH create a new Life Table Analysis System, LTAS.NET?

A-G2: The previous version, PC-LTAS, was created in the mid-1990s as a DOS-based program for the personal computer. There were several reasons why NIOSH has

created a new version for Windows, called LTAS.NET. The DOS environment has become unreliable in modern personal computing environments. There were also requests by users for new features that could not be accommodated in PC-LTAS. Lastly, minor discrepancies were noted in date handling and some statistical calculations that have been resolved in LTAS.NET.

Q-G3: How does the NIOSH LTAS.NET differ from previous versions of LTAS (e.g., PC-LTAS)?

A-G3: The most obvious difference is the computing platform. LTAS.NET is a stable, user-friendly and reliable NIOSH life table analysis system for the Windows environment. It is written in Microsoft® database engine platform, developed using Microsoft® Visual Studio®.NET and Microsoft® SQL Server Desktop Edition.

Other differences include:

- LTAS.NET has more flexible options than PC-LTAS for importing and analysis of data and reporting of results.
- The user can stratify on any number of user-defined fixed and time-dependent covariates and can analyze more than a single exposure simultaneously.
- The user can include a global categorical indicator variable that changes for everyone at the same time point
- The user can stratify workers by active and inactive employment status, with inactive status lagged by any length of time desired.
- There are two options for handling events and person-time that lag to zero. The user can include these in the lowest exposure category (default), or choose to include them in a separate category, as was done in PC-LTAS.
- The user can export stratified event and person-time data for more complex analyses (e.g., Poisson regression) in other software.
- Slight errors and inconsistencies in handling of dates and flagging of significance were corrected in LTAS.NET.

Q-G4: How does LTAS.NET 3.0 differ from LTAS.NET 2.0?

A-G4: The major change in LTAS 3.0 was to make it compatible with Windows Vista and Windows 7. We also changed the way the rate files are loaded in (we combined the cause map with the rate file). All changes are listed in the document titled "LTAS30.pdf" on the Documentation tab of the NIOSH/LTAS website

Q-G5: What operating systems do the different versions of LTAS.NET support?

A-5: LTAS.NET version 2.0 supports Windows 98/NT/2000/XP. LTAS.NET version 3.0 supports Windows XP/Vista/7. If you have Windows XP, you may operate LTAS.NET

2.0 and 3.0 side-by-side. Projects created in LTAS.NET 2.0 will have a “.ltas” extension, and projects created in LTAS.NET 3.0 will have a “.ltas3” extension.

Q-G6: Whom do I contact with questions or comments on LTAS.NET?

A-G6: Please direct all inquiries about the software to nioshltras@cdc.gov.

Q-G7: Will NIOSH continue to support PC-LTAS?

A-G7: With the release of LTAS.NET, NIOSH will no longer provide access to the older, DOS-based version of the Life Table program, PC-LTAS. NIOSH will no longer create new rate files for PC-LTAS. However, existing rate files for PC-LTAS will still be made available for download, for the benefit of current users of PC-LTAS.

Import

Q-I1: Are there conversion programs available that will convert PC-LTAS input files into LTAS.NET input files?

A-I1: We found there were too many variants based on the objectives of each cohort study to provide a generalized conversion program (for example, the user may need to make a new history file that incorporates several time-dependent covariates, as well as a person file that includes fixed additional covariates like SES).

The PC-LTAS demographic file can generally be used as the source of the Person file in LTAS.NET, selecting the variables needed as directed in the file input wizard in LTAS.NET. One can also easily create the Outcome file from the demographic file provided one recodes the ICD codes to include the decimal, if it exists in that code, and also adds variables to indicate whether the outcome is terminal (i.e., a cause of death) and whether it is underlying (see example SAS code below for a study using underlying causes of death only).

```
Data outcome;  
set demogr;  
length ucod $ 5;  
term='T';  
und='T';  
if substr(ucod,4,1)='X' then ucod1=substr(ucod,1,3);  
else if length(trim(ucod))>3 then ucod1=substr(ucod,1,3)||'.'||substr(ucod,4,1);  
else ucod1=ucod;  
run;
```

The PC-LTAS personal dose file can also generally be used as the history file without problem, if just a single time-dependent exposure (say, badge dose) is of interest. If use of duration of employment is also desired, then a “1” should also be included as the exposure level during the time periods over which employment occurs. This assigns a daily “exposure” of 1 day for each day of work (assuming a 365.25-day work-year). If one wishes to use area dose or include more than one time-dependent

exposure, it is best to start fresh because each line within the history file is a time period over which each time-dependent exposure is presumed to be a constant daily exposure.

Q-I2: When I run a cohort through LTAS.NET when the NIOSH 119 minor rate file is specified and the outcome file option to use the ICD revision “In Effect at the Time of Death” is selected, I noticed that ICD codes for all deaths occurring 1940-1949 are listed as an outcome file redemption with exception type “Unknown ICD”; however, the ICD codes for deaths occurring 1950-1959 are not described in this way. Is something wrong?

A-I2: The NIOSH 119 minor rate file begins in 1960 and includes codes from the 7th, 8th, 9th, and 10th revisions of the ICD. Deaths in 1940-1948 are assigned to the 5th revision of the ICD and deaths in 1949 are assigned to the 6th revision of the ICD. Since LTAS.NET verifies ICD codes for all outcomes against the rate file prior to rejecting outcomes for “Occurrence Date not in rates”, outcomes with codes under the 5th and 6th revisions of the ICD will be flagged as “Unknown ICD”. The user should be cautioned to check codes flagged as “Unknown ICD” for outcomes coded to the 7th, 8th, 9th, and 10th revisions of the ICD when the NIOSH 119 minor rate file is used; however, 5th and 6th revision codes flagged as “Unknown ICD” are not necessarily invalid.

Q-I3: When I run a cohort through LTAS.NET using the NIOSH 119 minor rate file and the time at risk option to end risk accumulation for workers lost to follow-up at the “Earlier of Date Last Observed or End of Study” is selected, I noticed that workers who are lost to follow-up prior to 1960 are not “rejected”, rather they receive a warning “rates not available – DLO”. In addition, these workers are “counted” in the LTAS.net import data processing window although they contribute 0 person-years at risk. Is something wrong?

A-I3: The NIOSH 119 minor rate file begins in 1960. Workers lost to follow-up prior to 1960 will not contribute person-years at risk to the analysis, unless the user specifies “End of Study” for the time at risk option to end risk accumulation. The user should be cautioned that when “Earlier of Date Last Observed or End of Study” is specified, workers who are lost to follow-up prior to 1960 are not rejected per se and therefore, the number of persons described as “available” at the end of import includes workers lost to follow-up prior to the rate begin date. Users may wish to subtract persons lost-to-follow-up prior to 1960 from the number of persons reported as “available”. However, the reported person-years at risk are correct for the cohort.

Q-I4: In looking at the import history file warnings report I am getting the message “> 1 history exception” for several workers. When I review their history data I can find no reason for exceptions. Why am I getting this message?

A-I4: When you receive this message look first at the person file rejection report. It is possible that the person has been rejected and that is why their history data is receiving the exception.

Stratify

Q-S1: When I run the same cohort data through LTAS.NET and PC-LTAS, I get slightly different person-years and events accruing to my various strata. Is LTAS.NET doing something wrong?

A-S1: In developing LTAS.NET, we discovered some inconsistencies in the way that PC-LTAS handles dates and transition days between stratified categories. The method used by LTAS.NET and how it differs from PC-LTAS are described in detail in Appendix A of the documentation (it can be found easily by searching on “date handling” from the Help pulldown menu). Extensive testing has confirmed that LTAS.NET is correctly stratifying data according to the description in Appendix A of the User’s Guide.

Q-S2: Is there a limit to the number of variables that can be included during stratify?

A-S2: LTAS.NET imposes a limit during stratify, but the limit is a function of both (a) the number of stratifier variables selected and (b) the number of categories associated with each variable. There are separate limits for fixed categorical variables and temporal variables (including global categorical, temporal categorical, and accumulating exposure agents). The intrinsic stratifier variables (usually gender, race, age and calendar period) are NOT included in the limit.

Let N_1 be the number of fixed categorical variables selected during stratify; F_i be the number of categories associated with the i^{th} fixed categorical, $i = 1, 2, \dots, N_1$; N_2 be the number of temporal variables selected during stratify; and T_j be the number of categories associated with the j^{th} temporal variable, $j = 1, 2, \dots, N_2$. The limit imposed by LTAS.NET is that both

$$\sum_i \lceil \log_2 F_i \rceil < 64 \text{ and } \sum_j \lceil \log_2 T_j \rceil < 64$$

where $\lceil x \rceil$ denotes the “ceiling” function (i.e., $\lceil x \rceil$ is the smallest integer that is greater than or equal to x ; e.g., $\lceil 1 \rceil = 1$, $\lceil 1.1 \rceil = 2$, $\lceil 1.99 \rceil = 2$, but $\lceil 2.0000000001 \rceil = 3$).

For example, suppose that in addition to gender, race, age, and calendar period, the user selects a global categorical variable for decade (7 categories), a fixed categorical variable that denotes facility (24 facilities), a temporal categorical variable for smoking status (3 categories), and a single accumulating exposure agent. Further suppose that the user selects duration, level, TSFE, and TSLE for the exposure agent and specifies cutpoints that result in 3, 30, 5, and 3 categories, respectively. Then $F_1 = 24$, $T_1 = 7$, $T_2 = 3$, $T_3 = 3$, $T_4 = 30$, $T_5 = 5$, and $T_6 = 3$. Since both $\lceil \log_2 24 \rceil = 5 < 64$ and $\lceil \log_2 7 \rceil + \lceil \log_2 3 \rceil + \lceil \log_2 3 \rceil + \lceil \log_2 30 \rceil + \lceil \log_2 5 \rceil + \lceil \log_2 3 \rceil = 3 + 2 + 2 + 5 + 3 + 2 = 17 < 64$, both limits are satisfied.

Next suppose that in addition to the previous 7 stratifier variables, the user selects 6 additional exposure agents, each with attributes level (30 categories) and TSFE (5 categories). Since $\lceil \log_2 30 \rceil = 5$ and $\lceil \log_2 5 \rceil = 3$, the new sum for T_j is $17 + 6(5+3) = 65$, which exceeds the limit. In this case, LTAS.NET will display the warning message: *“Arithmetic operation resulted in an overflow.”* The user is prompted to select “OK” to this message, at which time stratify terminates.

Users who encounter this scenario should not attempt to create analyze reports because there will be no person-time or observed deaths to analyze. The user will need to step through the stratifier wizard a second time, reducing the number of stratifier variables and/or the number of cutpoints associated with each variable, until both sums are less than 64.

Q-S3: How does LTAS.NET assign numerical exposure agents and temporal categorical variables to time periods that are not explicitly specified in the history file?

A-S3: Recall that exposure agents and temporal categorical variables are used to represent variables that are associated with a particular person but may change over time. Exposure agents are used to represent numeric, non-negative (accumulating) exposures (e.g., a daily average asbestos exposure level in fibers/ml); whereas, temporal categorical variables are used to represent categorical (non-accumulating) variables (e.g., smoking status: non-smoker, current smoker, and former smoker). In order to understand how LTAS.NET assigns numerical exposure agents and temporal categorical variables to time periods that are not explicitly specified in the history file, it is necessary to first understand how LTAS.NET treats history records with invalid or unexpected values for these variables:

- Any history file record that includes an imported exposure agent with a missing, character, or negative value will be rejected during Import. The Import Exceptions Report will list the rejection along with the reason “Invalid value”.
- Any history file record that includes an imported temporal categorical variable with a missing value will be rejected during Import. The Import Exceptions Report will list the rejection along with the reason “Stratifier is blank”.

Other reasons for which history file records are rejected during Import are described in Appendix C of the LTAS Manual (e.g., Begin Date after End Date results in a rejection of the history record). If two or more history file records for the same person are rejected during Import, the Import Exceptions Report will contain a warning (“> 1 history exception”). Any person with all history records rejected during Import will also be rejected during Import and identified in the Import Exceptions Report along with the reason “No history accepted”.

The “LTAS-derived risk begin date” is the latest of the rate begin date, the qualifying birth date, and any optional dates specified in the Time at Risk Options screen during the Import Wizard. LTAS.NET stratifies all person-time from the “LTAS-derived risk begin date” through the risk end date into groups defined by the intrinsic

stratifiers (e.g., gender, race, age group, and calendar period) plus any extrinsic stratifiers (e.g., asbestos-duration, asbestos-level, and smoking status). In order to do this, LTAS.NET must assume values for any exposure agent and temporal categorical variable included during Import for periods of time that are not explicitly included in the history file. Time periods that are not explicitly specified in the history file are called gaps. There are three types of gaps:

1. Anterior gaps represent time from the LTAS-derived risk begin date through the earliest history begin date. Anterior gaps are not “explicitly” filled and will only be present when the LTAS-derived risk begin date is prior to the history begin date.
 - a. Exposure agents are assumed to be zero for anterior gaps.
 - b. Importing temporal categorical and subsequently selecting one or more temporal categorical during the Stratify step will cause LTAS.NET to exclude all time in the anterior gap interval. The Stratify Rejects Report will identify persons with rejected person-time at risk because a temporal categorical variable was undefined.
2. Interior gaps represent time periods between the history end date for a given record and the history begin date for the next consecutive history record. Interior gaps are explicitly “filled” during Import. The number of interior gap fills will be enumerated in the Import Dialog Box.
 - a. Exposure agents are assumed to be zero for interior gaps.
 - b. Temporal categorical variables are assumed to be the most recent value for interior gaps.
3. Posterior gaps represent time from the latest history end date through the date last observed (DLO). Posterior gaps are not explicitly filled.
 - a. Exposure agents are assumed to be zero for posterior gaps.
 - b. Temporal categorical variables are assumed to be the most recent value for posterior gaps.

Q-S4: When should I use a temporal categorical instead of a numerical exposure agent in the history file?

A-S4: Temporal categorical variables are useful for representing exposure status variables that change over time, but that are not quantitatively accumulating. Examples of temporal categorical variables include

- Ever/never type exposure variables (e.g., ever exposed to asbestos could be included as a temporal categorical variable with values “yes” and “no”)
- Peak or highest exposure group (e.g., suppose employment periods were rated for potential to exposure using three categories: low, medium, and high. A temporal categorical variable could be included with values of “low”, “medium” and “high” to represent a worker’s highest category to-date)
- Exposure monitoring status (e.g., for a particular study, workers were classified as not monitored; ever monitored, but exposure was negative; ever monitored with some positive exposure)

- Cigarette smoking status (e.g., a temporal categorical variable could be used to represent cigarette smoking status using categories of non-smoker, current smoker, and former smoker).
- Exposure that should not be considered qualitatively cumulative (e.g., in a study examining risk of falls from a ladder, a temporal categorical variable could be used to indicate periods of active employment in construction separately from periods of other employment and periods of unemployment),

Depending on study objectives, for some variables it may be important to maintain a particular ordering of the categories. For example, if a temporal categorical variable was used to represent cigarette smoking status with three categories – non-smoker, current smoker, former smoker – a person could not become a non-smoker if they had previously been a current or former smoker. LTAS.NET, however, does not require any particular ordering, nor does it check for deviations from any assumed ordering. Gaps in the exposure history file (both interior gaps and an assumed gap between the exposure history end date and the risk end date) are assigned the most recent value of the temporal categorical; researchers should ensure that this is a valid assumption when interpreting results stratified by a temporal categorical variable.

Q-S5: When a lag period is applied to an exposure agent, how does LTAS.NET treat person-time at risk for workers with zero exposure?

A-S5: When a lag period is applied to an exposure agent, the user is given the option to “use a separate category for exposure lag time.”

- If the box is checked (i.e., requesting that LTAS.NET use a separate category for exposure lag time), then a worker with zero exposure to that agent will have person-time occurring between the “LTAS-derived risk begin date” (see Q-S3 for a definition) and this date plus the lag time length assigned to the “lagged time” category. Any subsequent person-time for such a worker is assigned to the lowest exposure category.
- If the box is not checked, then a worker with zero exposure to that agent will have all person-time assigned to the lowest exposure category.

Q-S6: LTAS behaves erratically when I try to use a lag of 365 days. What is wrong?

A-S6: This is due to an unresolved bug in LTAS.NET that occurs when a lag of more than 265 days is used. There is no problem in using lags of more than 265 days if the units are in years rather than days. Until this bug is resolved, users should employ units of years rather than days for lags of longer than 265 days.

Rate files

Q-R1: What rates are available for LTAS.NET?

A-R1: Currently, the LTAS.NET software contains underlying cause of death (UCOD) rates and proportions for the U.S. population from 1940-2014¹ (NIOSH-92) and an expanded set of rates and proportions for the U.S. population from 1960-2014¹ (NIOSH-119). Further information about these rates is provided in Robinson et al. (2006). J Occ Environ Med 48:662-667. Multiple cause-of-death rate and proportion files for the U.S. population, containing data through 2007, are also included in LTAS.NET version 3.0. Users may also download rates and proportions for each individual state from 1960-2014¹ at <http://www.cdc.gov/niosh/LTAS/states.html>. Each state rate of interest must be loaded into LTAS.NET using the “Manage Rates→Import Rate Set” pull-down menu.

Q-R2: I would like to import a state rate file containing updated rates through 2014, but I have already previously imported the same state rate file containing rates through 2002 or 2005. How do I accomplish this?

A-R2: The answer to this depends on whether you are using LTAS.NET version 3.0 or 2.0. With the release of LTAS.NET 3.0, it is now possible to delete obsolete rate files from LTAS.NET. Simply go to the storage location for the rate files (default location is C:\Program Files\NIOSH\LTAS.NET 3.0\Rates\) and delete the rate file that is no longer needed (e.g., AK119ur.xml for the Alaska 119-cause underlying rate file).

If, however, you are using LTAS.NET version 2.0, a more complicated procedure is required. The file name for the rate file, and the “name” and “description” within the XML file should all be different from those used in the previous version of the state rate file. In creating the updated state rate files, the “description” includes the year range from which rate file was created (e.g., 119 Underlying cause AZ Death Rates 1960-2005), which differs from the previous version of the state rate files. This “description” is how the file will be listed in the pull-down menu of the Import wizard of LTAS.NET. The “description” for any previously imported version of the rate file (e.g., 119 Underlying cause AZ Death Rates 1960-2002) will still be listed as well in the pull-down menu of the Import wizard of LTAS.NET, so users should choose rate files carefully from the pull-down menu.

Q-R3: Is it possible to delete obsolete rate files from LTAS.NET?

A-R3: Yes, if you are using LTAS.NET version 3.0 (but no if you are using version 2.0). For this reason, we recommend users switch to version 3.0. See the Q&A R2 for an explanation of the best way to handle re-uploading of new versions of rate files with the two different versions.

Q-R4: What do I need to create rate files for my own country?

A-R4: Rate files may be created easily by the user for LTAS.NET. This is done most easily in LTAS.NET version 3.0. In the rate file, the user must first create a cause

¹ Includes rate data through 2007. Rates in 2005-2007 are used for periods 2005-2009 and 2010-2014.

map is created (this may be copied from the two default maps in the LTAS.NET 3.0 NIOSH-92 and NIOSH-119 rate files), and a rate set is created with the actual rate data. This process is described in Appendix E of the documentation for LTAS.NET.

Q-R5: I noticed that some of the rate file categories appear to differ between the standard (92-cause) and expanded (119-cause) rate files. Why are they different?

A-R5: The following table documents the differences between the two rate files. Further information is provided in Robinson et al. (2006). J Occ Environ Med 48:662-667. The NIOSH-92 and -119 categories are described on the rate file page at <http://www.cdc.gov/niosh/ltas/rates.html>.

Cause of death	Treatment in 92-cause file	Treatment in 119-cause file
Malignant neoplasm (MN) of testis and other male genital organs	Minor 24 (MN other male genital) includes all male genital organs other than prostate	Minor 25 (MN testis) contains only testis. All other male genital other than prostate are in Minor 36 (MN other & unspecified site)

Q-R6: I just read about the updated version, LTAS.NET 3.0, and it appears that the mortality rates included in the program run through 2014. Do the rate data actually go through 2014?

A-R6: All NIOSH rate and proportion files released with LTAS.NET 3.0 currently contain data through 2007. The rates for the five-year period 2005-2009 (and any period beyond it) are estimated by the rate for 2005-2007.

Q-R7: What do I need to do to use multiple cause-of-death rate and proportion files?

A-R7: Multiple cause-of-death (MCOD) rate and proportion files are pre-loaded in LTAS.NET version 3.0. If you would like to conduct MCOD analyses, we recommend upgrading to this version of LTAS.NET.

Q-R8: Are there any cautions in using the multiple cause-of-death (MCOD) rate file?

A-R8: In testing the 1960-2002 US MCOD rates, we compared them to the 1960-2002 US UCOD rates for the 119 NIOSH minors. Generally, and as expected, the MCOD rate was greater than or equal to the UCOD rate; however, there were some instances for which the MCOD rate fell below the UCOD rate (approximately 4.5% of the rates):

(a) A majority of these (78%) involved calendar periods 01 (1960-1964) and 02 (1965-1969). Since MCOD information was not available prior to 1968, the 1965-1969 rate was based on data from 1968-1969 (1968 data was used for 1965-1967) and the 1960-1964 rate was assigned the 1965-1969 estimated rate. Consequently, for diseases that were rapidly increasing or decreasing in the 1960s, the 1960-1964 rate (and possibly the 1965-1969 rate) are somewhat inaccurate.

(b) The remaining instances (22% or about 1% of the overall rates) involved calendar periods in 1970 and later, but the reasons for these are not clear. Some instances involved calendar period 05 (1980-1984) and could have resulted from the lack of 100% MCOD coding in the years 1980 and 1982. Other instances involved Minor 014 (MN of Peritoneum and other and unspecified of digestive organs) for calendar period 09 (2000-2004) and could have resulted from changes in coding rules (e.g., a death certificate with C23 (MN of gall bladder) and C259 (MN of pancreas-unspecified) was assigned a UCOD of C269 (malignant neoplasm of other and ill-defined digestive organs – Ill defined sites within the digestive system), even though this cause, per se, did not appear on the death certificate). Still others involved age category 15 (85+ years). We will further investigate these apparent errors as we update the MCOD rate files in the future.

Q-R9: When re-importing a custom rate file that I had previously imported (e.g., entitled MyCustomFilename), I receive the following error message:

Cannot associate files with different databases.

Log file 'C:\Program Files\NIOSH\LTAS.NET\Data\MyCustomFileName_log.LDF' does not match the primary file. It may be from a different database or the log may have been rebuilt previously.

Deleting database file 'C:\Program Files\NIOSH\LTAS.NET\Data\MyCustomFilename.MDF'.

What is wrong and how do I fix it?

A-R9: A rate log file has become corrupted. The solution is to navigate to the subfolder named "C:\Program Files\NIOSH\LTAS.NET\Data\" in Windows Explorer, and to delete the referenced file with the .LDF extension (e.g., MyCustomFileName_log.LDF). You should then be able to re-import the MyCustomFilename rate file without further problem.

Q-R10: Is there a sort order requirement for the data in the rate file, if I am creating my own rates?

A-R10: Yes. The lines within the RateData element must be sorted by Gender, Race, Age, Calendar Period and Minor ID (i.e., the order specified by the intrinsic variables in the cause map).